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EXPLOITING THE DESERT'S ENERGY RESOURCE

by NARENDRA AGGARWAL

More solar energy reaches the Great Indian desert than many areas closer to the equator. Energy inflow from the sun into the deserts is, on average, 275 watts per square metre. This is because clear skies and better atmospheric conditions over the desert permit more solar radiation to reach the land.

This unending source of energy offers a great potential for reducing the miseries that desert conditions impose on the large populations that inhabit the Indian desert.

Known as the Thar desert, this area is unique in that it is the most densely populated desert in the world. Covering about 28,600 sq km in the northwest of the Indian continent, it spreads over more than half of Rajasthan State. Population density varies from four persons per sq km in Jaisalmer to 157 in Jhunjhunu. Between 1901 and 1971, its population increased by 158 percent to 8.84 million. The current estimate is about 10 million.

India is blessed with abundant solar energy and the quantum of energy received by Rajasthan state alone is more than sufficient to meet the world's annual energy demands.

Realizing the potential of this source of energy, the Central Arid Zone Research Institute (CAZRI) at Jodhpur in the Rajasthan desert is engaged in solar energy utilization research and has achieved early success, although on a modest scale.

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It has started a new research project on biogas plants with the objective of maximizing gas production in the winter months and on cloudy days when the amount of solar energy reaching the plant is reduced. To begin, the glasshouse approach is being tried. The gas plant has been enclosed in thick polythene, thus keeping out desert winds and trapping solar energy for more effective gas generation.

Scientists at the Institute have another simple method for raising gas production. Water heated through a solar water heater is used to make the slurry of *gobar* (cow dung) for feeding into the plant. Thus additional solar energy is fed into the plant resulting in increased gas generation.

Recently a solar water heater *cum* solar steam cooker has been developed. Consisting of a flat-plate collector, a storage tank and a steam cooker, it can supply 100 litres of water at 60-70^{o}C during winter afternoons, and 50-60^{o}C the next morning. Trials have shown that it can be used for cooking or boiling cereals, rice, potatoes, lentils, vegetables, etc. Two cooking vessels can be placed side by side and 1 kg of rice or potatoes can be boiled within 90 minutes.

The main raw materials used in this system -- pipes, plane sheets, aluminum angle, fibreglass insulation, glass sheets, etc. -- are all easily available. It costs US $150, including material and labour.

Sun drying agricultural produce to preserve it as seed, food or animal feed is an ancient practice in most parts of the world. This is the simplest form of solar energy use. But if a little solar technology is applied, a considerable amount of spoilage can be eliminated, and fuel and electricity saved.

The solar cabinet dryer fabricated at CAZRI is essentially a solar hot box in which fruits, vegetables or anything else can be dehydrated on a small scale. It consists of a rectangular wooden box with an insulated base area of 1.5 metres square, covered with clear glass tilted at an angle of 23 degrees. Holes are drilled in the base for fresh air to enter. The humid air escapes through outlets in the upper side of the cabinet.

Maximum air temperatures in the empty dryer vary from 55 to 95°C. Under Jodhpur conditions, 15 kg of chillies and 15 kg of dates were dehydrated, and 15 kg of grapes were converted into raisins, in two to four days. The solar cabinet costs only US $35. Permanent large solar dryers can be made from bricks, stones or concrete.

Five different types of solar cookers were field tested at the institute and it was found that the solar oven was best for the desert. It consisted of a well insulated semi-cylindrical box made of aluminum and wood. The interior is painted black. The window has two transparent glass sheets. Eight reflectors made of silvered glass mirrors are also used. The oven costs US $40 and it can be manually tilted and oriented towards the sun.

On very clear days, maximum plate temperature in the oven reaches 350°C during the summer and 250°C in the winter. Practically all foods can be roasted, baked, or boiled within 25 to 75 minutes. This solar oven is highly efficient as its performance is not affected by winds and there are no chances of dust falling in the cooking pot. Moreover the food remains warm even after sunset if kept inside the cooker.

A built-in storage type solar water heater that is cheap, efficient and useful for rural as well as urban areas has also been developed at the CAZRI. It consists of a rectangular tank which holds about 90 litres of water. This tank performs the dual function of absorbing the heat and storing the heated water. It is encased in a tray, insulated at the back and sides, and covered with glass. The front face of the absorber tank is painted black to absorb the maximum solar radiation.

On winter afternoons, 90 litres of water can be heated to 50-60°C, while in summer, the temperature of the water rises to 60-80°C. By using a reflector/insulator cover, the water temperature can be raised further.

Fresh water collection in arid, semi-arid and coastal areas that are thinly populated is a time consuming exercise as it has to be brought from far off places. In these areas solar energy is plentiful and can be used for converting

saline water into distilled water. At CAZRI, experimental solar stills have been fabricated and are being tested. Including the capital cost, depreciation cost, maintenance cost and interest on investment, the cost of distilled water comes to only 35 cents US per 100 litres.

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